Federal Aviation Administration

Memorandum

Date: March 28, 2014

To: Manager, Boeing Aviation Safety Oversight Office, ANM-100B
Manager, Seattle Aircraft Certification Office, ANM-100S

From: Manager, Transport Airplane Directorate, ANM-100

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Subject: INFORMATION: Critical Casting Factor Requirements for Model 787 Series Aircraft

ELOS Memo #: PS13-0679-CS-33

Regulatory Ref: §§ 21.21(b)(1), Notice of Proposed Rulemaking (NPRM); Docket FAA-2013-0109, 25.561, 25.621, EASA Certification Specification (CS) 25.621

This memorandum informs the certificate management aircraft certification office of an evaluation made by the Transport Airplane Directorate (TAD) on the establishment of an equivalent level of safety (ELOS) finding for the Boeing Model 787.

Background

The Boeing Company has proposed to pursue characterizing certain cast parts incorporated in passenger seat designs and installed on Model 787 series aircraft as following a premium casting process which would allow utilization of a casting factor of 1.0 or greater for critical castings in structural applications. The existing airworthiness regulations require such critical castings to apply a minimum casting factor of 1.25. The Boeing proposal is intended to establish an equivalent level of safety to the existing airworthiness regulations by aligning with the guidance outlined in Federal Aviation Administration (FAA) draft Advisory Circular (AC) 25.621-X, "Casting Factors" and European Aviation Safety Agency (EASA) Acceptable Means of Compliance (AMC) 25.621, "Casting Factors", Amendment 25/1.

Title 14, Code of Federal Regulations (14 CFR) 25.621 currently requires that critical castings in structural applications have a minimum casting factor of 1.25. This casting factor is applied in addition to the factor of safety required by § 25.303, "Factor of Safety", to account for variability in mechanical properties due to the casting process, which can result in imperfections within the cast part.

The FAA has proposed revision of § 25.621, and certain other regulations, based on recommendations from the Aviation Rulemaking Advisory Committee (ARAC). The purpose of the proposed revision of the rule is to harmonize the airworthiness standards of the FAA and EASA without adding new requirements and, thus, minimizing the effect on current industry design practices.

The FAA proposes to revise § 25.621 to define "critical casting" and clarifies the quality control, inspection, and testing requirements for critical and non-critical castings. A casting factor of 1.0 would be allowed by the proposed rule because casting technology has improved since the current rule was adopted and higher quality castings can be produced using improved foundry methods. The allowance of a casting factor of 1.0 or greater would be based on the provisions that one casting undergoes static testing and is shown to meet the relevant strength and deformation requirements, and it is demonstrated that a process is in place to ensure the castings produced have material variation equivalent to those of wrought alloy products of similar composition.

Draft AC 25.621-X, which was posted for comment concurrently with the proposed rule, outlines a process for using a casting factor of 1.0. The content of draft AC 25.621-X is consistent with EASA AMC 25.621 as intended.

Applicable regulation(s)

Section 21.21(b)(1), Notice of Proposed Rulemaking (NPRM); Docket FAA-2013-0109, 25.621, EASA Certification Specification (CS) 25.621.

Regulation(s) requiring an ELOS finding

§ 25.621

Description of compensating design features or alternative standards which allow the granting of the ELOS finding (including design changes, limitations or equipment need for equivalency)

The compensating alternative standards which allow the granting of the ELOS finding is by following EASA CS 25.621 and AMC 25.621. The higher quality castings that result from following these standards creates confidence that a casting factor of 1.0 for critical castings is sufficient. In this regard, the EASA certification specification and associated guidance material allows for qualification of a premium casting process to produce critical castings with a casting factor of 1.0 or greater under certain conditions outlined in AMC 25.621. As required by EASA CS 25.621(c)(1)(i), the following major steps are essential in characterizing a premium casting process: qualification of the process, proof of the product, and monitoring of the process.

Explanation of how design features or alternative standards provide an ELOS to that intended by the regulation

The use of EASA CS 25.621 and AMC 25.621 provides for an ELOS to the associated FAA regulation because cast parts produced under a "premium casting process" will meet the relevant strength/deformation requirements and have material variation equivalent to those of wrought alloy products of similar composition.

FAA approval and documentation of the ELOS finding

The FAA has approved the aforementioned ELOS finding in project Issue Paper CS-33, titled "Critical Casting Factor Requirements." This memorandum provides standardized documentation of the ELOS finding that is non-proprietary and can be made available to the public. The TAD has assigned a unique ELOS memorandum number (see front page) to facilitate archiving and retrieval of this ELOS finding. This ELOS memorandum number should be listed in the type certificate data sheet under the Certification Basis section in accordance with the statement below:

Equivalent Level of Safety Findings have been made for the following regulations:

§ 25.621 Casting Factors
(documented in TAD ELOS Memorandum PS13-0679-CS-33)

Transport Airplane Directorate,
Aircraft Certification Service

Date

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